

## I. Amendments to the Specification

Kindly amend paragraphs [0021] - [0024], as follows:

[0021] In yet another of its aspects, the present invention provides a process for producing a foamed isocyanate-based polymer comprising the steps of: (i) contacting an isocyanate, an active hydrogen-containing compound, a dendritic macromolecule and a blowing agent to form a reaction mixture; and (ii) expanding the reaction mixture to produce the foamed isocyanate-based polymer; (iii) wherein at least a 15% by weight of the dendritic macromolecule may be mixed with a polyether polyol having an OH number less than about 40 mg KOH/g to form a stable liquid at 23° C.

[0022] ~~contacting an isocyanate, an active hydrogen-containing compound, a dendritic macromolecule and a blowing agent to form a reaction mixture; and~~ In yet another of its aspects, the present invention provides a composition of matter comprising an isocyanate, an active hydrogen-containing compound, a dendritic macromolecule and a blowing agent; wherein a mixture comprising at least about 15% by weight of the dendritic macromolecule and a polyether polyol having an OH number less than about 40 mg KOH/g forms a stable liquid at 23°C.

[0023] ~~expanding the reaction mixture to produce the foamed isocyanate-based polymer;~~ The present invention utilizes a novel group of dendritic macromolecules which may be conveniently incorporated in polyurethane foam. Surprisingly and unexpectedly, it has been further discovered that the novel group of dendritic

macromolecules confer significant load building properties to the polyurethane foam matrix and may be used for this purpose to partially or fully displace current relatively expensive chemical systems which are used to confer load building characteristics to polyurethane foam. This effect will be illustrated below in the Examples section.

[0024] ~~wherein at least a 15% by weight of the dendritic macromolecule may be mixed with a polyether polyol having an OH number less than about 40 mg KOH/g to form a stable liquid at 23° C~~ A feature of the present dendritic macromolecule is that at least a 15% by weight of the dendritic macromolecule may be mixed with a polyether polyol having an OH number less than about 40 mg KOH/g to form a stable liquid at 23°C.

Kindly amend paragraph [0053], as follows:

[0053] Further details on the dendritic macromolecule may be obtained from copending U.S. patent application Ser. No. 60/221,512, filed on Jul. 28, 2000 and from International patent application PCT/SE01/01518, ~~•/•~~ filed on July 2 Jun. 29, 2001 (claiming priority from the '512 application), both in naming Pettersson et al. In particular, as stated above, the present dendritic macromolecules are characterized by:  
(i) an active hydrogen content of greater than about 3.8 mmol/g; (ii) an active hydrogen functionality of at least about 8; and (iii)at least a 15% by weight of the dendritic macromolecule may be mixed with a polyether polyol having an OH number less than about 40 mg KOH/g to form a stable liquid at 23° C. As used throughout

this specification, the term “active hydrogen functionality” is intended to mean the number of active hydrogen moieties per molecule of the dendritic macromolecule. The general architecture of the present dendritic macromolecules is similar to other such macromolecules. Specifically, the present dendritic macromolecules may be derived from: (a) a central monomeric or polymeric nucleus, (b) at least one generation of a branching monomeric or polymeric chain extender have a plurality of reactive sites comprising an active hydrogen-containing moiety, and (c) optionally, at least one monomeric or polymeric chain stopper which serves to terminate the macromolecule. The central monomeric or polymeric nucleus included in the hyperbranched macromolecule is not particularly restricted and, in a preferred embodiment, is suitably selected from the groups of central monomeric or polymeric initiators disclosed in Hult and Sörensen referred to above and the contents of each of which are hereby incorporated by reference. The chain extender(s) included in the hyperbranched macromolecule is not particularly restricted and, in a preferred embodiment, is suitably selected from the groups of chain extenders disclosed in Hult and Sörensen referred to above and the contents of each of which are hereby incorporated by reference. The chain stopper, if used in the hyperbranched macromolecule is not particularly restricted and, in a preferred embodiment, is suitably selected from the groups of chain stoppers disclosed in Hult and Sörensen referred to above and the contents of each of which are hereby incorporated by reference. The present dendritic macromolecules may be of the so-called ester type, for example, as described by Hult and Sörensen. Alternatively, the present dendritic macromolecules may be of the so-called ether type, for example, as described by Magnusson et al. in Macromol. Rapid Commun. 20, 453-457 (1999). Further, the

dendritic macromolecule need not necessarily include a central monomeric or polymeric initiator. Specifically, the macromolecule may be a polymer derived directly from the chain extender(s) - this will be illustrated in Example G. As will be developed hereinbelow in the Examples (see particularly Example G), it is possible to select the chain extender to achieve a dendritic macromolecule having solubility parameter (iii) set out above, without the need for the use of a chain stopper.

Kindly add new paragraphs [0097] - [0144], as follows:

#### EXAMPLE B

[0097] 16.7 kg of an alkoxylated pentaerythritol with a hydroxyl value of 630 mg KOH/g, 375 kg of 2,2-dimethylolpropionic acid (Bis-MPA, Perstorp Specialty Chemicals) and 3.0 kg of paratoluenic sulphonic acid were cold mixed in a reactor equipped with a heating system with accurate temperature control, a mechanical stirrer, a pressure gauge, a vacuum pump, a cooler, nitrogen inlet and a receiver. The mixture was heated carefully during slow stirring to a temperature of 140°C. Slow stirring of the mixture at this temperature was maintained at atmospheric pressure until all 2,2-dimethylolpropionic acid was dissolved and the reaction mixture formed a fully transparent solution. The stirring speed was then significantly increased and vacuum was applied to a pressure of 30 mbar. Reaction water immediately started to form, which was collected in the receiver. The reaction was allowed to continue for a further 8 hours, until a final acid value of 11.9 mg KOH/g was obtained. This corresponded to a chemical conversion of ~97%.

[0098] The obtained dendritic polymer had the following characteristics:

Final acid value:	11.9 mg KOH/g
Final hydroxyl value:	481 mg KOH/g
Peak molecular weight:	5110 g/mole
Mw (SEC):	5092 g/mole
Mn (SEC):	3041 g/mole
PDI (Mw/Mn):	1.67
Average hydroxyl functionality:	43.8 OH-groups/molecule

[0099] The obtained properties were in good agreement with the expected theoretical molecular weight of 7316 g/mole at 100% chemical conversion and a theoretical hydroxyl value of 491 mg KOH/g, which would correspond to a OH-functionality of 64.

#### EXAMPLE C

[0100] 83.6 kg of an alkoxylated pentaerythritol with a hydroxyl value of 630 mg KOH/g, 375.0 kg of 2,2-dimethylolpropionic acid (Bis-MPA, Perstorp Specialty Chemicals) and 3.25 kg of paratoluenic sulphonic acid were cold mixed in a reactor equipped with a heating system with accurate temperature control, a mechanical stirrer, a pressure gauge, a vacuum pump, a cooler, nitrogen inlet and a receiver. The mixture was heated carefully during slow stirring to a temperature of 140°C. Slow stirring of the mixture at this temperature was maintained at atmospheric pressure until all 2,2-dimethylolpropionic acid was dissolved and the reaction mixture formed a fully transparent solution. The stirring speed was then significantly increased and vacuum was applied to a pressure of 30 mbar. Reaction water immediately started to form, which was collected in the receiver. The reaction was allowed to continue for a further 7.5 hours, until a final acid value of 6.0 mg KOH/g was obtained. This corresponded to a chemical conversion of ~98%.

[0101] The obtained dendritic polymer had the following characteristics:

Final acid value:	4.7 mg KOH/g
Final hydroxyl value:	508 mg KOH/g
Peak molecular weight:	1998 g/mole
Mw (SEC):	1997 g/mole
Mn (SEC):	1451 g/mole
PDI (Mw/Mn):	1.37
Average hydroxyl functionality:	18 OH-groups/molecule

[0102] The obtained properties were in good agreement with the expected theoretical molecular weight of 1750 g/mole at 100% chemical conversion and a theoretical hydroxyl value of 513 mg KOH/g, which would correspond to a OH-functionality of 16.

#### EXAMPLE D

[0103] 25.0 kg of the dendritic polymer according to Example A, 8.4 kg of an aliphatic acid with nine carbons with an acid value of 363 mg KOH/g and 3.3 kg of xylene were charged to a reactor equipped with a heating system with accurate temperature control, a mechanical stirrer, a pressure gauge, a vacuum pump, a dean-stark device for azeotropic removal of water, a cooler, nitrogen inlet and a receiver. The mixture was heated under stirring with a nitrogen flow of 500-600 l/h through the reaction mixture from room temperature up to 170°C. At this temperature all xylene was refluxing and the reaction water which started to form was removed by azeotropic distillation. The reaction was allowed to continue for a further 1.5 hours at 170°C, after which the reaction temperature was increased to 180°C. The reaction mixture was kept at this temperature for a further 2.5 hours until an acid value of 5.7 mg KOH/g was obtained. Full vacuum was then applied to the reactor to remove all xylene from the final product.

[0104] The obtained derivatized dendritic polymer had the following characteristics:

Final acid value:	6.2 mg KOH/g
Final hydroxyl value:	293 mg KOH/g
Peak molecular weight:	4351 g/mole
Mw (SEC):	4347 g/mole
Mn (SEC):	1880 g/mole
PDI (Mw/Mn):	2.31
Average hydroxyl functionality:	22.7 OH-groups/molecule

[0105] The obtained properties were in good agreement with the expected theoretical molecular weight of 4699 g/mole at 100% chemical conversion and a theoretical hydroxyl value of 287 mg KOH/g, which would correspond to a OH-functionality of 24.

#### EXAMPLE E

[0106] 25.0 kg of the dendritic polymer according to Example C, 5.25 kg of an aliphatic acid with nine carbons with an acid value of 363 mg KOH/g and 3.0 kg of xylene were charged to a reactor equipped with a heating system with accurate temperature control, a mechanical stirrer, a pressure gauge, a vacuum pump, a dean-stark device for azeotropic removal of water, a cooler, nitrogen inlet and a receiver. The mixture was heated under stirring with a nitrogen flow of 500-600 l/h through the reaction mixture from room temperature up to 180°C. At this temperature all xylene was refluxing and the reaction water which started to form was removed by azeotropic distillation. The reaction was allowed to continue for a further 5 hours at 180°C until an acid value of 6.0 mg KOH/g was reached. Full vacuum was then applied to the reactor to remove all xylene from the final product.

[0107] The obtained derivatized dendritic polymer had the following characteristics:

Final acid value:	6.0 mg KOH/g
Final hydroxyl value:	360 mg KOH/g

Peak molecular weight:	2700 g/mole
Mw (SEC):	2733 g/mole
Mn (SEC):	1673 g/mole
PDI (Mw/Mn):	1.61
Average hydroxyl functionality:	17.3 OH-groups/molecule

[0108] The obtained properties were in reasonable agreement with the expected theoretical molecular weight of 2080 g/mole at 100% chemical conversion and a theoretical hydroxyl value of 367 mg KOH/g, which would correspond to a OH-functionality of 13.6.

#### EXAMPLE F

[0109] 25.0 kg of the dendritic polymer according to Example B, 8.3 kg of an aliphatic acid with nine carbons with an acid value of 363 mg KOH/g and 3.3 kg of xylene were charged to a reactor equipped with a heating system with accurate temperature control, a mechanical stirrer, a pressure gauge, a vacuum pump, a dean-stark device for azeotropic removal of water, a cooler, nitrogen inlet and a receiver. The mixture was heated under stirring with a nitrogen flow of 500-600 l/h through the reaction mixture from room temperature up to 180°C. At this temperature all xylene was refluxing and the reaction water which started to form was removed by azeotropic distillation. The reaction was allowed to continue for a further 5 hours at 180°C until an acid value of 6.8 mg KOH/g was reached. Full vacuum was then applied to the reactor to remove all xylene from the final product.

[0110] The obtained derivatized dendritic polymer had the following characteristics:

Final acid value:	6.8 mg KOH/g
Final hydroxyl value:	280 mg KOH/g
Peak molecular weight:	5274 g/mole
Mw (SEC):	5245 g/mole



Mn (SEC):	2428 g/mole
PDI:	2.16

[0111] The obtained properties were in reasonable agreement with the expected theoretical hydroxyl value of 283mg KOH/g.

#### EXAMPLE G

[0112] 200.0 g of trimethylolpropane oxetane (TMPO, Perstorp Specialty Chemicals) was charged to a reactor equipped with a mechanical stirrer, a cooler and a heating system with adequate heating control. 2.0 g of a solution of BF<sub>3</sub> etherate (10% in diethylether) was charged at room temperature to the reactor during less than 120 seconds. A strong exotherm was seen as a result of the ring opening polymerization of the oxetane monomer. Once the exotherm faded, the reaction mixture was heated to 150°C and kept at that temperature under stirring for a further 90 minutes. The reaction mixture was then cooled to room temperature at which the final product was recovered.

[0113] The obtained dendritic polymer of polyether type had the following characteristics:

Final hydroxyl value:	500 mg KOH/g
Peak molecular weight:	6307 g/mole
Mw (SEC):	5309 g/mole
Mn (SEC):	2011 g/mole
PDI:	2.64
Average hydroxyl functionality:	56 OH-groups/molecule
Chemical conversion:	99.4% with regard to residual monomer content

#### EXAMPLE H

[0114] The solubility of each of the dendritic polymers according to Examples A-C in a glycerol based polyether polyol with an hydroxyl value of 32 mg KOH/g was evaluated.

[0115] 15.0 g of the respective dendritic polymer according to Examples A-C was added to a beaker containing 75.0 g of a glycerol based polyether polyol with a hydroxyl value of 32 mg KOH/g. The mixture was heated under stirring to 120°C during 30 minutes and then allowed to cool down to room temperature. The ability for each dendritic polymer to form a stable solution with the polyether polyol was evaluated after 120 minutes.

[0116] None of the dendritic polymers according to Examples A-C were able to form a stable solution with the glycerol-based polyether polyol of hydroxyl value 32 mg KOH/g. The dendritic polymers according to Examples A-C partly precipitated from the solution and this could be observed in the form of a separate phase at the bottom of the beaker.

#### EXAMPLE I

[0117] The solubility of each of the dendritic polymers according to Examples D-F in a glycerol based polyether polyol with an hydroxyl value of 32 mg KOH/g was evaluated.

[0118] 15.0 g of the respective dendritic polymer according to Examples D-F was added to a beaker containing 75.0 g of a glycerol based polyether polyol with a hydroxyl value of 32 mg KOH/g. The mixture was heated under stirring to 120°C during 30 minutes and then allowed to cool down to room temperature. The ability for each dendritic polymer to form a stable solution with the polyether polyol was evaluated after 120 minutes.

[0119] All of the evaluated dendritic polymers according to Examples D-F were fully soluble in the glycerol based polyether polyol. Fully transparent solutions were obtained in all cases, which were stable over time. Due to the excellent solubility, samples of higher concentrations based on the products obtained according to Examples D-F. These were then evaluated with regard to viscosity at 23°C. Samples of different concentrations of dendritic polymer according to Examples D-F in polyether polyol were prepared and found to be fully compatible with the base glycerol based polyether polyol. These stable solutions remained as such even after 30 days.

[0120] The attached Figure illustrates the viscosity dependence in a polyether polyol of the products according to Examples D-F. As can be seen from the results illustrated in the attached Figure, very good solubility behaviour of the products according to Examples D-F were obtained.

#### EXAMPLE J

[0121] The solubility of the dendritic polymer of polyether type according to Example G in a glycerol based polyether polyol with an hydroxyl value of 32 mg KOH/g was evaluated.

[0122] 15.0 g of the dendritic polymer according to Example G was added to a beaker containing 75.0 g of a glycerol based polyether polyol with a hydroxyl value of 32 mg KOH/g. The mixture was heated under stirring to 120°C during 30 minutes and then allowed to cool down to room temperature. The ability for the product according to Example 7 to form a stable solution with the polyether polyol was evaluated after 120 minutes.

[0123] It was found that the dendritic polymer of polyether type according to Example G formed an opaque but completely stable solution with the glycerol based polyether polyol.

**EXAMPLE K - SYNTHESIS OF AMINE-TERMINATED DENDRITIC POLYMER  
OF POLYETHER TYPE**

**[0124]** An amine terminated dendritic polymer of polyether type is prepared according to the following principal synthesis procedure:

**[0125]** Step 1: A dendritic polymer of polyether type according to Example G and a suitable solvent such as tetrahydrofuran (THF) are charged to a reactor equipped with a mechanical stirrer, a heating system with adequate temperature control, a cooler, gas inlet, a vacuum pump and a receiver. When a transparent solution has been obtained, NaOH or KOH or NaH are added in stoichiometric amount or with a slight excess, at which the dendritic alkolate is formed ( $\text{RONa}^+$ ).

**[0126]** Step 2: Acrylonitrile is added in a stoichiometric amount with regard to the moles of  $\text{RONa}^+$  species present in the reaction mixture from Step 1. The alkolated species will then undergo an addition to the unsaturation of the acrylonitrile. The obtained product in Step 2 has therefore been converted to a nitrile terminated dendritic polymer of polyether type.

**[0127]** Step 3: The nitrile functionality of the reaction product according to Step 2 is converted to primary amines by: (i) reducing the pH of the reaction solution by adding protons to the solution, (ii) thereafter passing  $\text{H}_2$  (g) through the reaction mixture in the presence of a reducing catalyst such as Pt, Pd or Raney Ni neat or fixated (e.g., to a carbon carrier); and (iii) thereafter recovering the obtained amine functional dendritic polymer of polyether type by conventional washing and extraction procedures.

[0128] Further details on specifics of these reaction steps may be found in House, H.O., Modern Synthetic Reactions, 16-19, Benj. Cumm. Publ. (1972).

#### EXAMPLE L - AMINE-TERMINATED DENDRITIC POLYMER OF POLYESTER TYPE

[0129] A fully or partially-amine terminated dendritic polymer of polyester type according to any of the Examples A-F is prepared according to the following principal synthesis procedure:

[0130] Step 1: A dendritic polymer of polyester type according to any of the Examples A-F, acrylic acid in a ratio COOH:OH of [0.1:1] to [1:1] with regard to the hydroxyl value of the dendritic polymer and a protonic acid such as methane sulphonic acid (~1 wt% concentration of the total solution), one or several inhibitors for radical polymerisation (e.g., MIHQ or HQ) and a solvent such as toluene or a mixture of, for example, toluene and THF, are charged to a reactor equipped with a mechanical stirrer, a dean-stark separator, adequate temperature control, nitrogen inlet, a cooler and a receiver. The reaction mixture is heated to 100 - 130°C, typically 110 - 120°C, at which point the solvent is starting to reflux and water is starting to form. The reaction is allowed to continue at said temperature until a low acid value of 5 B 30 mg KOH/g is reached, preferably 5-15 mg KOH/g. The product is then used as such or further purified by either washing with a weak aqueous solution of NaOH, or the residual acrylic acid is precipitated with, for example, Al<sub>2</sub>O<sub>3</sub>.

[0131] Step 2: The acrylated product according to Step 1 is then reacted with a primary aliphatic, cycloaliphatic or aromatic amine such as propyl amine, isopropyl amine, octyl amine, butyl amine (n, sec, tert) or benzyl amine. The amine of choice is added in stoichiometric amount

or in excess to the acrylated product of Step 1, at which an addition reaction to the unsaturation of the dendritic acrylate will occur. The reaction is either performed at room temperature or a slightly elevated temperatures such as 50°C. The conversion of acrylate to amine is either followed by IR or NIR by the disappearance of acrylate unsaturations, or by GC- analysis of the residual amine content in the reaction mixture. Obtained amine terminated dendritic polymer of polyester type is then recovered by evaporating residual monomer and solvent by applying full vacuum to the reactor.

#### EXAMPLES M-Q

[0132] Examples M-Q illustrate the use of the present dendritic polymer in a typical isocyanate-based high resilience (HR) based foam. In each Example, the isocyanate-based foam was prepared by the pre-blending of all resin ingredients including polyols, copolymer polyols (if used), catalysts, water, and surfactants as well as the dendritic macromolecule of interest (if used). The isocyanate was excluded from this mixture. The resin blend and isocyanate were then mixed at an isocyanate index of 100 using a conventional two-stream mixing technique and dispensed into a preheated mold (65°C) having the dimensions 38.1 cm x 38.1 cm x 10.16 cm. The mold was then closed and the reaction allowed to proceed until the total volume of the mold was filled. After approximately 6 minutes, the isocyanate-based foam was removed and, after proper conditioning, the properties of interest were measured. This methodology will be referred to in Examples M-Q as the General Procedure.

[0133] In Examples M-Q, the following materials were used:

E837, base polyol, commercially available from Lyondell;

E850, a 43% solids content copolymer (SAN) polyol, commercially available from Lyondell;

HBP, a dendritic macromolecule produced in Example D above;

DEAO LF, diethanolamine, a cross-linking agent commercially available from Air Products;

Glycerin, a cross-linking agent, commercially available from Van Waters & Rogers;

Water, indirect blowing agent;

Dabco 33LV, a gelation catalyst, commercially available from Air Products;

Niax A-1, a blowing catalyst, commercially available from Witco;

Y-10184, a surfactant, commercially available from Witco; and

Lupranate T80, isocyanate (TDI), commercially available from BASF.

[0134] Unless otherwise stated, all parts reported in Examples M-Q are parts by weight.

[0135] In Examples M-O, isocyanate-based foams based on the formulations shown in Table 6 were produced using the General Procedure referred to above.

[0136] In Examples M-O, isocyanate based foams were prepared in the absence of any copolymer polyol. The isocyanate-based foams were formulated with a % H<sub>2</sub>O concentration of 3.8% resulting in an approximate foam core density of 31 kg/m<sup>3</sup>. The level of the dendritic macromolecule was varied from 6.68% to 13.35% by weight in the resin.

[0137] The results of physical property testing are reported in Table 6. Also reported in Table 6 for each foam is the density and Indentation Force Deflection (IFD) at 50% deflection, measured pursuant to ASTM D3574. As shown, the introduction of the dendritic macromolecule to the isocyanate-based polymer matrix resulted in a ~98 N hardness increase for foam from Example M to Example N, and a ~83 N hardness increase for the foam from Example N to Example O.

[0138] By this analysis, a "load efficiency" for each foam may be reported and represents the ability of the dendritic macromolecule to generate firmness in the

isocyanate based foam matrix. The load efficiency is defined as the number of Newtons of foam hardness increase per % of the dendritic macromolecule in the resin blend. The term "load efficiency", as used throughout this specification, is intended to have the meaning set out in this paragraph.

[0139] As shown, the introduction of the dendritic macromolecule resulted in a foam hardness increase of 181N. The resulting load efficiency is 27N/% dendritic macromolecule in the resin.

[0140] In Examples P and Q, isocyanate-based foams based on the formulations shown in Table 7 were produced using the General Procedure referred to above.

[0141] In Examples P and Q, isocyanate based foams were prepared in the absence of any dendritic macromolecule and used only copolymer polyol as the method by which foam hardness is increased. Thus, it will be appreciated that Examples P and Q are provided for comparative purposes. The isocyanate-based foams were formulated with a %H<sub>2</sub>O concentration of 3.8% resulting in an approximate foam core density of 31 kg/m<sup>3</sup>. The level of the copolymer polyol was varied from 26% to 8% by weight in the resin.

[0142] The results of physical property testing are reported in Table 7. As shown, the introduction of the copolymer polyol resulted in a foam hardness increase of 192.1 N. The resulting load efficiency is 10.69 N/% copolymer polyol in the resin. As will be apparent, this is significantly less than the load efficiency achieved in the foams produced in Examples M to O.



**TABLE 6**

	Example		
Ingredient	M	N	O
E837	92.8	89.2	85.6
E850	-	-	-
HBP	7.2	10.8	14.4
DEOA LF	1.1	1.1	1.1
Glycerin	0.6	0.6	0.6
H <sub>2</sub> O	3.93	3.93	3.93
Dabco 33LV	0.411	0.452	0.492
Niax A-1	0.08	0.08	0.08
Y10184	1	1	1
Total resin	107.12	107.16	107.2
Lupranate T80	51.737	53.197	54.658
Index	100	100	100
% H <sub>2</sub> O	3.8	3.8	3.8
% SAN in resin	0	0	0
% HBP in resin	6.68	10.01	13.35
Total dry weight (g)	476	471	473
Density (kg/m <sup>3</sup> )	31	31	31

50% IFD (N)	301.6	399.9	482.6
% Hysteresis	34.9	39.3	42.6
Load Efficiency	27.13		

**TABLE 7**

Ingredient	Example	
	P	Q
E837	34.85	79.95
E850	65.15	20.05
HBP	-	-
DEOA LF	1.1	1.1
Glycerin	0.6	0.6
H <sub>2</sub> O	3.93	3.93
Dabco 33LV	0.33	0.33
Niax A-1	0.08	0.08
Y10184	1	1
Total resin	107.04	107.04
Lupranate T80	40.817	41.432
Index	100	100
% H <sub>2</sub> O	3.8	3.8
% SAN in resin	26	8
% HBP in resin	0	0
Total dry weight (g)	550	556
Density (kg/m <sup>3</sup> )	31	31

50% IFD (N)	468.4	276.3
% Hysteresis	38.4	29.1
Load Efficiency	10.69	

**[0143]** While this invention has been described with reference to illustrative embodiments and examples, the description is not intended to be construed in a limiting sense. For example, while esterification/acid derivatization and ring-opening techniques were used in some of the Examples to produce embodiments of the novel dendritic macromolecules, other derivatization techniques such as transesterification, polyaddition reactions, free radical polymerization and the like can be used. Thus, various modifications of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications or embodiments.

**[0144]** All publications, patents and patent applications referred to herein are incorporated by reference in their entirety to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated by reference in its entirety.